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Image credit: Stephen Gibson, Justin Love, Jim Olson.

Repurposed Interface, Repurposed Medium, Repurposed Content

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Abstract: This physical computing project proposes a circle of re-purposing, in which both the interface and content are repurposed, and portions of the content are updated according to geographical location of its exhibition. The artefact employed is a repurposed bicycle intended to navigate computer-based environments. There is a history of cycle repurposing for this intention, from Jeffrey Shaw's Media Art project *The Legible City* to commercial sports cycle simulators such as Tacx; however, very few projects propose a repurposing of a cycle interface along with the content, as well as a geographically-specific repurposing. The main research concern continues a 25-year project by the author into the formal and material uses of 'found, sampled and stolen' (Media N, 2012) objects. While this concept has been explored in extensive terms in relation to Sound and Media Art, in Interaction Design the uses of repurposed materials has yet to be extensively theorised. This paper proposes a provocation in the form of a repurposed artefact, not merely for the purpose of denying originality, but as a means of illustrating how repurposing can create a skewed version of the original(s) and therefore create new meaning. In the face of limited resources, repurposing also serves as a potentially advantageous option for Interaction Designers.

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Introduction

Interaction Design is now a hybrid medium, employing skills, research and techniques from Design, Human Computer Interaction (HCI), Computer Science, and Psychology, amongst others. Despite this the actual outputs produced by Interaction Designers are often firmly located in the craft of traditional Design. This is particularly true of artefacts produced by and/or for large agencies and organisations. A particular notion of craft is often the norm: conventional notions of originality are foregrounded, and a focus on particular ideas of handwork are considered an essential part of the process leading to a unique outcome. While there are examples of groups existing at the fringes of Interaction Design (e.g. The Light Surgeons, Squidsoup, the 'Maker' community) who do not conform to this general tendency, a substantive body of Interaction Design practice could be said to be located in a pre-postmodern state; that is, they continue to adhere to notions of modernism, even as most other forms have proceeded through postmodernity and come out the other end into some form of post-conceptual hybridity.

Notions of originality have been exhaustively theorised in the context of the broader arts, including in Walter Benjamin's seminal text *The Work of Art in the Age of Mechanical Reproduction*, in which Benjamin convincingly argues that the original loses its 'aura' in the face of an ability to mechanically reproduce an artefact (Benjamin, 1935). Various versions of "The Work of Art in the Age of Digital Reproduction" have

Figure 1. Submergence. Photo: Squidsoup.

followed on from this, including Douglas Davis' paper from 1995, which maintains that "there is no longer a clear conceptual distinction between original and reproduction in virtually any medium. These two states, one pure and original, the other imitative and impure, are now fictions" (Davis, 1995, p. 381). Issues of copyright notwithstanding, perfect copies of an original are now easily reproducible and can be infinitely transmitted through digital means. This does not necessarily mean that the notion of originality does not exist or that objects cannot be "original" (i.e. new or innovative); however, the original object has very little meaning the digital world of infinite reproducibility.

Interaction Design and Media Art in My Work

I come to Interaction Design through Media Art; that is, I employ Interaction Design techniques in order to create Media Art artefacts. While engaging with processes common to Interaction Designers when creating interfaces, my ultimate goal is to create pieces of work that are 'exhibitable' in a Media or Fine Art context. Certainly this is not an entirely unique perspective or circumstance. For example, work by Squidsoup such as *Submergence,* and other works that have formed parts of their *Ocean of Light* series, use both Interaction Design and HCI strategies to create artistic pieces that are not meant to be replicated for distribution or used in a traditional Design context.

What is interesting to note here is that there are examples of Media Art work that employ tools and strategies from Interaction Design, and deploy them in an art context. What is more unusual is for Interaction Designers to employ strategies borrowed from Media Art. In this regard this paper and presentation seeks to provoke the Interaction Design community to consider other modes of content-creation beyond the normative 'craftiness' of Design.

Related Work in Sound

My background includes a 30+ year history with sound and music. My PhD thesis was completed in Music Composition and consisted of a book and CD released together. The CD was made up of tracks built out of samples from radically different sources, combined together in order to demonstrate the malleable nature of sound in the face of sampling technology. As part of this process I was interested in the formal implications of sampling: what did using existing audio sources mean for the form of piece of music, and what did sampling techniques imply for a time-based medium? One solution proposed was that sampling could be used to demonstrate the malleable and variable nature of a sound object, such as a voice sample. This could be alternately pitched at very high register (creating a hyper-female voice) or a very low register (creating a hyper-male voice). The hyper-female voice could be moved slowly down until it reached its initial normal register, while the hyper-male voice could also be moved slowly up to its normal register. The resulting form would be extrapolated from a reconstruction of a human voice over time, thus creating a time-based form based on the possibilities inherent in sampling technology: http://www.telebody.ws/RTD/Windows-Strata.mp3 (Gibson and Kroker, 1993).

The notions of both found-object malleability and time-based formalism that were developed in my sound based work have continued to inform my Media Art and Interaction Design practices. I continue to work with sampled audio, visual, and multimedia sources (including game engines) that I mutate in order to create work that is based on existing material, but has been reconfigured to change either the form or the meaning of the content being used. This is borne out in several projects, but for this paper I will concentrate on my work for the accompanying artefact for exhibition, *Grand Theft Bicycle*.

Repurposing in Contemporary Music and Media Art

In his classic paper "The Turntable," Charles Mudede describes the repurposing of the turntable as an interface for transforming and manipulating music rather as a simple playback device (Mudede, 2003). Mudede concentrates his argument around the use of the turntable in hip-hop: "The turntable is a repurposed object. It is robbed of its initial essence. But the void is soon refilled by a new essence which finds it meaning, its place in the hip-hop universe, in the service of the DJ" (Mudede, 2003). He argues that the repurposing of the turntable in hip-hop creates a sort of 'meta-music' where both the form and the content are based on existing materials (both the interface and the sounds are borrowed and reconfigured). He differentiates this from other sample-based music, citing the Art of Noise as an example of a group that used 'real world' samples within a composed context (Mudede, 2003).

The use of the turntable as a repurposed device is interesting for our discussion because it is a device that was intended for one purpose, which has then been repurposed for a related but distinct purpose. The re-use of the turntable in hip-hop has some implications for the form and content of the music or 'meta-music' that is created using it, the most obvious of which are: the source record is present in one form or another (even if it is scratched out of all recognition) and the repurposed interface of the turntable is transformed into an instrument, or 'meta-instrument' (to extrapolate from Mudede).

Figure 2. The Legible City. Photo: Jeffrey Shaw.

Similarly, in Media Art there is a history of repurposed devices used for functions other than for which they were originally intended. These can range from simple hacks of common objects such as the *Arduino Air Drums* by Maayan Migdal (Migdal, 2011) to large scale reconfigurations of military-grade tools, such as *Vectorial Elevation* by Rafael Lozano-Hemmer (Lozano-Hemmer, 1999). More directly related to the concerns of this paper, and to the supporting artefact, is Jeffrey Shaw's seminal project *The Legible City* (1989-91). Consisting of a repurposed bicycle used to ride through a 3D text world based on the street-layout of either Manhattan, Amsterdam and Karlsruhe, the project exemplifies both the use of an existing device as a new interface for control of manipulated content. The cityscapes serve as sampled materials for

generating a route through various textual landscapes, just as the bicycle interface serves as an interactive navigational device, rather than a tool for transportation or exercise (Shaw, 1989). In this way, *The Legible City* serves as an excellent starting point for a discussion of repurposed interfaces, content and geographic locations.

Game Art and Game Mods

Since the accompanying artefact to this paper is used to control a Game Art project, it is worth recounting some details about Game Art and Game Modding. There is now an established history of Game Art projects which repurpose game engines and game consoles. These range from simple ambient pieces such as Cory Arcangel's *Super Mario Clouds,* which consists of "an old Mario Brothers cartridge which I [Arcangel] modified to erase everything but the clouds" (Arcangel, 2002), to complex mods with political overtones such as Wafaa Bilal's *Virtual Jihadi,* which repurposes a US Army recruitment game and turns it on its head by adding characters such as George W. Bush (Bilal, 2008). Game designers and gaming companies have encouraged such repurposing to an extent, with the release of source code and game engines for prominent games such as Quake, Doom and Unreal. This has led to a plethora of Game Mods using the above games as source. These have less merit to our discussion though, as they are usually conceived of as either extensions of the original games or fawning tributes.

Repurposing (or a lack thereof) in Interaction Design

Existing at the periphery of Interaction Design, Arduino/physical computing work developed in the 'Maker' community and in other hacking spaces, is arguably the clearest example of repurposing that makes use of Interaction Design strategies. It could be argued however, that much of the work produced by this community, while created using Experiential and/or Interaction Design methods (i.e. user Interaction models in these projects are often based on known Interactive Design strategies such as naturalistic user interaction), is in fact intended for a more Fine Art purpose (and is generally exhibited in an Arts context). This is exemplified by the work shown in "Art, Design, and the Arduino Microcontroller" exhibit at NYC Resistor in 2010 - http://www.youtube.com/watch?v=pn_hxGk-6LA (IEEE Spectrum, 2010). Much of the work exhibited here (and at related events such as MakerFaire) are one-offs produced for display at a Gallery or Arts venue. In addition, much of this type of work is conceptually more related to Fine Arts practice: a good example of this is shown in the above video link at 1 min 10 sec. This demonstrates a work by Sascha Torres that uses algorithmically programmed robots to paint an abstract expressionist painting. Both the form of the work produced, and the somewhat ironic intention are more directly related to Fine Arts conceptualism, rather than any Design-related concept. In short these works represent similar Design-Art hybrids to my own work, in which

Interaction Design strategies are used to produce work for a Media or Fine Arts context. The boundaries are blurred in these cases (and in many other examples), but it would be fair to say that these works exist outside the general norms of Interaction Design practice, if only by virtue of their mode of dissemination and exhibition method.

Repurposing a Bike for Game Art

The accompanying artefact to this paper consists of a bike fitted with a number of sensors, that is used to navigate all aspects of a standard computer game. The bike can navigate through any joystick enabled game, as it has all of the standard controls one would expect on a joystick. The data is passed on to a PC computer via the Create User Interface invented by Dan Overholt.

For *Grand Theft Bicycle* an explicit Interaction Design strategy was used to develop the bike interface. This strategy is similar to the ones discussed in relation to the Arduino/physical computing community above. This focus on explicit Interaction Design methods is distinct from most Media Art and Game Art, in which interface design is often non-existent, a side issue, or at best somewhat improvised. The design of the bicycle interface was based on a naturalistic user interface model (Harrison, 2006) in which the simplest user actions are mapped to very obvious and logical results in a game environment: e.g. turning the steering column turns the avatar's bike, pedalling increases the avatar's speed on the bike. While this may seem like basic design logic, in the Media Art world interfaces that are confusing (either accidentally or by design) are more the norm. The bike interface was re-designed in direct opposition to my experience of one too many Media Art exhibits that were impossible to navigate because the interface design was too impenetrable. The intent was to take the repurposed object of the bike into the world of the game controller, and make its use as seamless and transparent as possible.

While this interface strategy was very much indebted to the naturalistic interaction model proposed by Harrison and others, it is unusual for an Interaction Design model such as this to be applied to a repurposed object. Interaction Design's basic adherence to notions of craft and/or

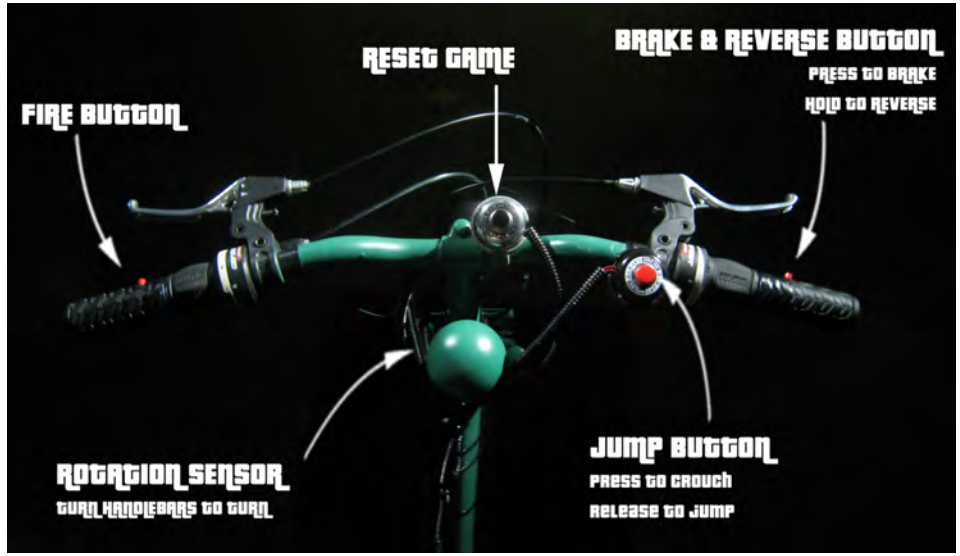

Figure 3. Grand Theft Bicycle interface design. Photo: Steve Gibson.

originality, as well as the fact that Interaction Design practice often serves a direct commercial purpose, habitually means that repurposing is not even considered as an option. There is no reason that this should not change, at least for the use of interfaces. There are many objects and devices that can be used to do tasks that they were not originally intended for, and repurposing these objects saves resources.

Figure 4. Grand Theft Bicycle in-game play. Photo: Steve Gibson.

Repurposing a Game Engine for Dadaist Provocation

While the design of the bike interface was very much based on a coherent Interaction Design model, the resulting project was conceived much more as a Dadaist Media Art provocation. I have written extensively on the links between Dadaism and the work of artists who work with game mods. For the sake of succinctness, I will quote myself here as way of introducing the basic concept of the project:

"*GTB* [*Grand Theft Bicycle*] is knowingly conceived as a Dadaist (anti-) art game, with stated intentions to provoke, confuse, infuriate and contradict…. The initial concept of *GTB* was to create an absurdist mix of aerobics, radical politics and first-person shooter using an infamously violent and nihilistic game (*GTA*) [*Grand Theft Auto*] as the basis for a mod. For *GTB* we kept certain-aspects of the *GTA* game intact, including the AI, the general 3D textures, and the overall 3D environment; however, instead of gangsters the characters have all been replaced with politicians, the generally innocuous but juvenile signs from *GTA* have all been changed to reflect aspects of the war on terror and/or capitalist culture, and all goals have been removed" (Gibson, 2012).

The process for modding the game was a laborious one: the original game (*GTA: San Andreas*) is closed source, and therefore to alter the game we had to use somewhat unreliable tools that were

uncommented and undocumented. As stated above, the AI behaviours and the 3D environment from the source game were kept intact; however, all other elements were replaced, including the title movie, the characters (including all character voices), plus all signs, billboards and window displays. This required us to pick out each audio or visual object from the source game and replace them individually.

Each gang character from *GTA* was re-skinned with an image of a politician, and his or her dialogue was replaced by speeches from that politician. Characters were chosen from a broad array of politicians, representing opposing sides of the war on terror (Bush Jr., Bin Laden), cold war figures (Reagan, Gorbachev) as well as more contemporary politicians (Obama, Clinton). We assigned each group of related characters to the original gang AI structure that *GTA: San Andreas* utilised. This meant that characters with political allegiances (i.e. Bush, Blair, Harper) could form one gang and would fight against gangs with other allegiances. If the rider attacked one gang, that gang would fight back against the rider's avatar and opposing gangs would fight with him or her.

Figure 5. Grand Theft Bicycle characters. Two different characters from GTB. Photo: Steve Gibson.

Geographically-specific Character Repurposing

For each exhibition of *Grand Theft Bicycle* we have added a native character to localize the content in a simple yet effective way. For Calgary we added the then Canadian Prime Minister Steven Harper (who was also MP for Calgary Southwest), for Zurich we added the then Swiss Foreign Minister Hans-Rudolf Merz - which was picked up by the local Zurich press in an article that could be loosely translated as "Merz shoots wildly in killer-game" (Torcasso, 2010) - and for ISEA 2012 in Albuquerque we added Obama. For the exhibition in Edinburgh we have included a Scottish politician, Alex Salmond (an ideal figure given his 'big' personality). He is integrated into a gang of moderately liberal Western politicians, including Obama and Clinton.

The intro movie for the Zurich exhibition, which shows all characters, and includes my cover of Gary Numan's *Cars* (a nod to the original *GTA:SA* which used 80s synth-pop), can be viewed here: http://telebody.ws/RTD/GTB_titles_Zurich_edited.mov.

Repurposed Interface, Repurposed Medium, Repurposed Content

Referring back to Mudede's concept of the turntable discussed above, the repurposed bicycle in *Grand Theft Bicycle* has a similar character to the repurposed turntable in hip-hop. The bike serves as a sort of 'meta-cycle': as a bicycle it was intended for one purpose (cycling, and related

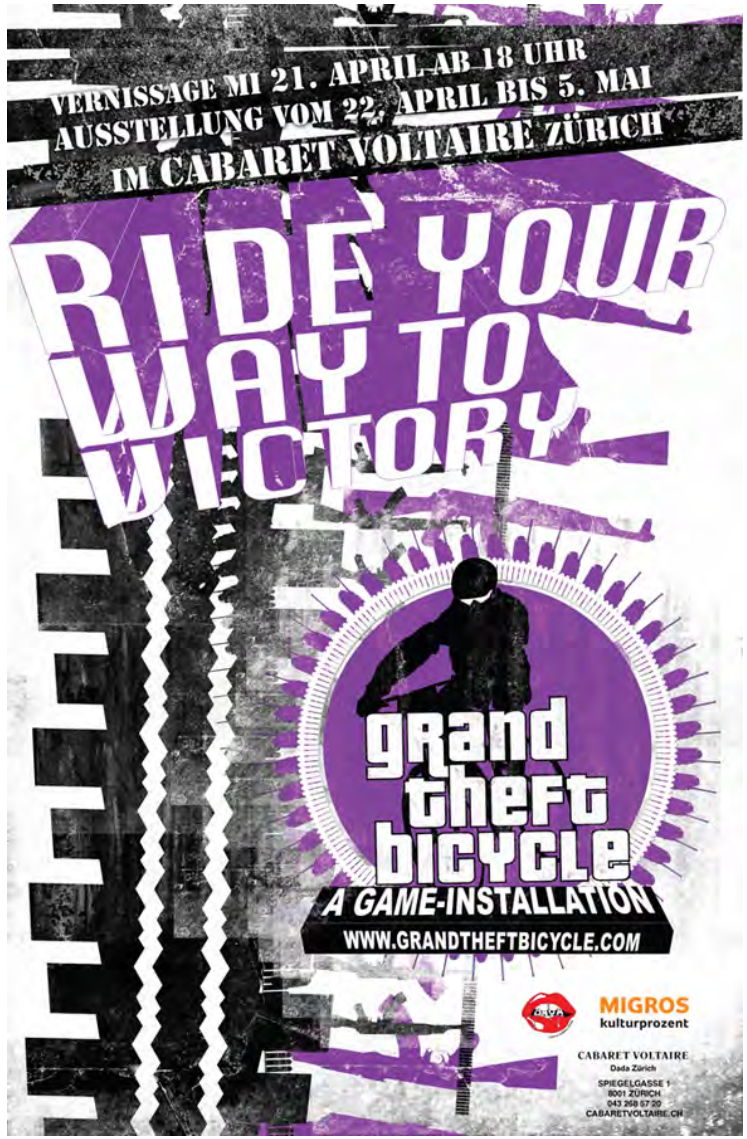

Figure 6. Grand Theft Bicycle poster for Cabaret Voltaire exhibition, Photo: Jim Olson.

goals of transport and exercise), which has then been repurposed for a related but distinct purpose (game play, with a related goal of exercise). The repurposed bike refers to the act of cycling, and one must cycle to use the interface, but the "new essence" (Mudede, 2003) of its meaning is now found as a game controller. Its interface and medium of use have been repurposed.

Similar to my sample-based audio work discussed above, *Grand Theft Bicycle* also seeks to find a 'form' for digitally-based game narratives. However, unlike recorded music, which proceeds through time and has a beginning, middle and end, most computer games (especially first-person shooters) are by nature either meandering or aimless. They can be started and stopped at any point, other players can change the outcome of the experience, and while one might try to gain points, weapons or cash there isn't a 'winner' or even a goal as there is in a traditional board game such as *Monopoly.* With this in mind we intensified the formlessness of the first-person shooter medium by eliminating all goals: in *Grand Theft Bicycle* we removed the user's ability to pick up weapons and cash, there is no way to finish the game, and we have made it impossible for the members of any political gang to kill the rider's avatar. In short, the formal implications of using a first-person shooter game engine are realised in *Grand Theft Bicycle* by emphasising the aimlessness of the first-person shooter.

Audience Response to the Repurposed Interface, Medium and Content

Having observed audience members interacting with *GTB* in diverse locales such as Open Space Artist-run Centre in Victoria, Canada, Xi'an Academy of Fine Arts in China, and Cabaret Voltaire in Zurich, it is evident that the use of the naturalistic user interface, combined with the repurposed interface and content, has rendered the user interaction in *GTB* immediately understandable and easily navigable. There has not been a single observed case in which an audience member was mystified or unable to understand and use the bike interface. This includes more than a thousand users who experienced the project in China. The utilisation of an Interaction Design strategy that employed a literal interface, naturalistically designed with obvious control mappings such as pedalling to on-screen bike speed, is undoubtedly partially responsible for this. In addition, the repurposed object of the bicycle played an important part in aiding the audience's interactive experience: since bike controls are familiar to the vast majority of the population in Europe, North America and Asia, users were immediately able to use the device with absolutely no instruction. From this perspective the repurposed object of the bicycle was demonstrably successful, and almost certainly more easy to decipher and master for the audience than a specially-designed user interface might be.

Figure 7. Grand Theft Bicycle at Digital Art Weeks 2010, Xi'an Academy of Fine Arts, China. Photo: Steve Gibson.

Similarly the use of a familiar game engine in *Grand Theft Auto* made the on-screen world recognisable to many users, even if the original characters were replaced by the new figures, and the game-play was (modestly) altered. The addition of political figures of various nationalities and diverse political allegiances made the game-play more noticeably entertaining and engaging for the audience. Users were often observed attacking one or another gang of political figures, and this was clearly related to objects of their disapproval. Interestingly a minority of users were observed ignoring the game characters and simply taking an aimless ride in the varied landscapes of the game environment (and often never firing a shot). This was a somewhat unexpected mode of game-play for the piece: in all beta-tests of the piece no users interacted in this way. We nonetheless welcomed this development, as it demonstrated that the both repurposed interface and content could adapt to unexpected interactions.

Certainly there is no doubt that the project did infuriate, which was one of the objectives of the piece. The bulk of the fury directed at *GTB* came via the press, and most commonly from the political figures represented in the game (as discussed in relation to the addition of the Swiss Foreign Minister in the Zurich version of the piece). It is worth noting that there was not one observed user who was infuriated by the interface. In this regard the repurposed interface of the bicycle was highly effective as the central interface.

Prodding Interaction Design Towards Repurposing

At the outset of this paper I proposed this project as a provocation directed (at least in part) to Interaction Design. *Grand Theft Bicycle* is interesting because it uses an Interaction Design model for its interface design, but the aim is to create a piece for Fine Art exhibition. In short it is a hybrid entity, with Design as its core technical driver, but Media Art as its main output. Again this is not an entirely unique situation, as pointed out earlier (with Squidsoup and the Light Surgeons serving as related examples). However, the goal of this provocation is to prod more conventional Interaction Design to consider repurposing more seriously. As discussed above, there is some evidence that this is already happening at the fringes of Design, with the plethora of Arduino/physical computing projects previously mentioned. As previously argued, these projects could be considered Design-Art hybrids, but the mode of exhibition and the focus on topics related more to Fine Arts conceptualism/post-conceptualism, renders many of the actual outputs as more evidently Media Art rather than Design.

Referring back to my original argument that a sizeable body of Interaction Design work exists in a pre-postmodern state: many outputs are produced apparently unaware (or disregarding) that we have passed through postmodernism into a post-conceptual state. It could also be argued that a significant body of Interaction Design practice remains entrenched in modernism – "All of Us" in London presents several good examples of modernist Interaction Design - or at best has passed over postmodernism and (somewhat naively) come straight to post-conceptualism. This state exists despite many theorists of New and Digital Media forcefully making the case that the original object no longer has meaning in the digital world (this is the entire point of the seminal text on digital media and originality, *The Reconfigured Eye* by William Mitchell).

As a counter argument, in Interaction Design higher-education programmes, the techniques of Physical Computing and Experiential Design are now taught as standard: therefore, it may be that the next generation of Interactions Designers will be more likely to consider repurposing as a viable option, even for projects of a more commercial nature. There are some indications that this is already the case, as illustrated by this project by former Northumbria Interaction Design student Emma Nicol: http://emmanicol.co.uk/portfolio/iuvo/ (Nicol, 2014). The project consisted of a projected robotic head that responded to voice commands and was able to switch on and off various common household appliances. The project made use of repurposed objects (such as a fan hacked to be voice-controlled), as well as originally produced projection-mapped visuals, and a specially designed head for the avatar. It therefore makes use of hybrid materials, both repurposed and original. Rather critically, the goal of the project was to create an Interaction Design output rather than a Fine Art exhibit, as evidenced by the stated aim on the project website: "IUVO is a voice activated home automated device designed to make your life easier and more convenient" (Nicol, 2014). *Iuvo* therefore firmly is situated as an Interaction Design output rather than a Fine or Media Art piece.

Interestingly *Iuvo* was picked up by a commercial agency and remarketed as a more standard personal location-based assistant: http://orangebus.co.uk/insights/Introducing-Iuvo-at-Innovation-Week (Orange Bus, 2015). This demonstrates there is capacity for developing repurposed devices in the commercial Interaction Design domain.

In general though, in Interaction Design content is still often seen as the domain of the 'original,' in which 'made for purpose' objects (either tangible or virtual) do not generally evidence any borrowing, sampling or repurposing. This is undoubtedly partly due to the commercial nature of many Interaction Design outputs: if something is being sold (e.g. a website, an interaction design for a shopfront) then issues of copyright and ownership are in play (though the meaning of copyright is certainly in flux in the digital era). Recognising that *Grand Theft Bicycle* is intended for Media or Fine Art exhibition, it does have less strict limitations regarding the use of repurposed content.

It is worth reiterating that the content *Grand Theft Bicycle* was repurposed using a closed source game engine. Interestingly the producers of *GTA* – Rockstar Games – have allowed a number of mods of *GTA* to exist without any punitive action being applied to modders. As long as they are not being sold, these mods are allowed to have a life of their own. Other games producers with open source engines, such as Unreal or Half-Life, will allow modders to sell their mods, and there are licencing arrangements in which the original game producers take a share of whatever is earned. This open source model perhaps serves as a better model for Interaction Design for the use of repurposed content.

Figure 8. Grand Theft Bicycle at ISEA 2012, Albuquerque Museum of Art and History. Photo: Rasmus Vuori.

On the other hand, it could also be argued that in the digital age copyright law is in drastic need of being revisited. This argument has been raging for years and any timely resolution seems unlikely. Plainly though, as stated at the outset and above, the nature of the original has undergone a radical transformation in the digital age, and arguing for a certain preciousness in relation to interface, object and content now perhaps seems quaint (Davis, 1995).

Without becoming too prescriptive about it, it is worth considering a new model for creation of Interactive interfaces, forms, mediums and content. Whether the best model is a sharing model based on open source culture, or whether repurposing offers some long-term Design value (particularly in relation to newer ideas surrounding "The Internet of Things') is difficult to predict; however, this paper has shown that repurposing in various degrees can be a viable and useful option for both dealing with limited material and human resources, and for developing new collaborative work. *Grand Theft Bicycle* serves as demonstrable model for the positive benefits of repurposing an interface, the medium and the content. The use of the familiar object of the bicycle, along with the established medium of the computer game and the repurposed political content, created an immediate entry point into the project for the audience, allowing them to have a personal experience without the need for learning a new interface, medium or content. It is envisaged that this strategy can point a way forward for other Interaction Designers and for others interested in pushing the boundary between Media Art and Design.

Video documentation

A video demonstrating *Grand Theft Bicycle* at ISEA 2012 in Albuquerque can be viewed at: http://telebody.ws/RTD/GTB_ISEA2012_edit_OnlyGTB.mov.

Acknowledgements

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